Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the present application:

1. (Canceled)

2. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said plurality of low-frequency acoustic modes comprise modes selected from cavity induced low-frequency acoustic modes, structural vibration induced low-frequency acoustic modes, low-frequency acoustic modes excited by idle engine firings, and combinations thereof.

3. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said motion sensor comprises an accelerometer.

4-5. (Canceled)

6. (Currently Amended) A system for actively damping boom noise as claimed in claim [[4]] 66 wherein said motion sensor signal is representative of a single structural vibration induced low-frequency acoustic mode.

7. (Currently Amended) A system for actively damping boom noise as claimed in claim [[4]] 66 wherein said motion sensor signal is representative of a plurality of structural vibration induced low-frequency acoustic modes.

8. (Withdrawn - Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said enclosure further defines a middle roof panel and a rear roof panel.

9. (Withdrawn) A system for actively damping boom noise as claimed in claim 8 wherein a middle panel motion sensor is secured to said middle roof panel and a rear panel motion sensor is secured to said rear roof panel.

10. (Withdrawn) A system for actively damping boom noise as claimed in claim 9 wherein said middle panel motion sensor comprises an accelerometer and said rear panel motion sensor comprises an accelerometer.

11. (Withdrawn) A system for actively damping boom noise as claimed in claim 9 wherein said middle panel motion sensor is configured to produce a middle panel motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes and wherein said rear panel motion sensor is configured to produce a rear panel motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes.

12. (Withdrawn) A system for actively damping boom noise as claimed in claim 11 wherein said middle panel motion sensor signal comprises an electric signal indicative of measured acceleration detected by said middle panel motion sensor as a result of structural vibration of said middle roof panel and wherein said rear panel motion sensor signal comprises an electric signal indicative of measured acceleration detected by said rear panel motion sensor as a result of structural vibration of said rear roof panel.

13. (Withdrawn) A system for actively damping boom noise as claimed in claim 11 wherein said middle panel motion sensor signal is representative of a single roof structural vibration induced low-frequency acoustic mode and said rear panel motion sensor signal is representative of a single roof structural vibration induced low-frequency acoustic mode.

14. (Withdrawn) A system for actively damping boom noise as claimed in claim 13 wherein said middle panel motion sensor signal and said rear panel motion sensor signal are representative of the same roof structural vibration induced low-frequency acoustic mode.

15. (Withdrawn) A system for actively damping boom noise as claimed in claim 13 wherein said middle panel motion sensor signal and said rear panel motion sensor signal are representative of different roof structural vibration induced low-frequency acoustic modes.

16. (Withdrawn) A system for actively damping boom noise as claimed in claim 11 wherein said middle panel motion sensor signal is representative of a plurality of roof structural vibration induced low-frequency acoustic modes and said rear panel motion sensor signal is representative of a plurality of roof structural vibration induced low-frequency acoustic modes.

17. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave sensor comprises a microphone.

18. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave sensor is positioned within said enclosure.

19. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave sensor is configured to produce an acoustic wave sensor signal representative of at least one of said plurality of low-frequency acoustic modes.

20. (Original) A system for actively damping boom noise as claimed in claim 19 wherein said acoustic wave sensor signal comprises an electric signal indicative of measured acoustic resonance detected by said acoustic wave sensor within said enclosure.

21. (Original) A system for actively damping boom noise as claimed in claim 19 wherein said acoustic wave sensor signal is representative of a single cavity induced low-frequency acoustic mode.

22. (Original) A system for actively damping boom noise as claimed in claim 19 wherein said acoustic wave sensor signal is representative of a plurality of cavity induced low-frequency acoustic modes.

23. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ ~~wherein said~~ further comprising an acoustic damping controller ~~defines a first~~ defining an additional electronic feedback loop input coupled to an acoustic wave sensor signal and ~~a first~~ an additional electronic feedback loop output, wherein said ~~first~~ additional electronic feedback loop is configured to generate ~~a first~~ an additional electronic feedback loop output signal by applying a feedback loop transfer function to said acoustic wave sensor signal.

24. (Canceled)

25. (Withdrawn - Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said ~~second~~ electronic feedback loop further defines a middle panel vibro-acoustic controller in parallel with a rear panel vibro-acoustic controller.

26. (Withdrawn) A system for actively damping boom noise as claimed in claim 25 wherein said middle panel vibro-acoustic controller defines a middle panel vibro-acoustic controller input coupled to a middle panel motion sensor signal and a middle panel vibro-acoustic controller output, wherein said middle panel vibro-acoustic controller is configured to generate a middle panel vibro-acoustic controller output signal by applying a feedback loop transfer function to said middle panel motion sensor signal.

27. (Withdrawn) A system for actively damping boom noise as claimed in claim 25 wherein said rear panel vibro-acoustic controller defines a rear panel vibro-acoustic controller input coupled to a rear panel motion sensor signal and a rear panel vibro-acoustic controller output, wherein said rear panel vibro-acoustic controller is configured to generate a rear panel vibro-acoustic controller output signal by applying an electronic feedback loop transfer function to said rear panel motion sensor signal.

28. (Withdrawn - Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~25~~ wherein a middle panel vibro-acoustic controller output signal and a rear panel

vibro-acoustic controller output signal are combined to generate ~~a second~~ said electronic feedback loop output signal.

29. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave actuator substantially collocated with said acoustic wave sensor is positioned within said enclosure and wherein said acoustic wave actuator is responsive to a first electronic feedback loop output signal and a second electronic feedback loop output signal.

30. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave actuator substantially collocated with said acoustic wave sensor are positioned to correspond to the location of the acoustic anti-node of a target acoustic mode within said enclosure.

31. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said acoustic wave actuator introduces characteristic acoustic dynamics into said system and wherein said first and second electronic feedback loops are configured to introduce inverse acoustic dynamics into said system.

32. (Original) A system for actively damping boom noise as claimed in claim 29 wherein said first and second electronic feedback loop output signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator.

33. (Currently Amended) A system for actively damping boom noise as claimed in claim 66 ~~1~~ wherein said enclosure comprises a cabin of an automobile.

34. (Original) A system for actively damping boom noise comprising:

an enclosure defining a plurality of low-frequency acoustic modes;

an acoustic wave sensor positioned within said enclosure, wherein said acoustic wave sensor is configured to produce an acoustic wave sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

a motion sensor secured to a panel of said enclosure, wherein said motion sensor is configured to produce a motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

an acoustic wave actuator substantially collocated with said acoustic wave sensor and positioned within said enclosure, wherein said acoustic wave actuator is responsive to a first electronic feedback loop output signal and a second electronic feedback loop output signal;

a first electronic feedback loop defining an acoustic damping controller, wherein said acoustic damping controller defines a first electronic feedback loop input coupled to said acoustic wave sensor signal and a first electronic feedback loop output, wherein said first electronic feedback loop is configured to generate said first electronic feedback loop output signal by applying a feedback loop transfer function to said acoustic wave sensor signal, wherein said feedback loop transfer function comprises a second order differential equation including a first variable representing a predetermined damping ratio and a second variable representing a tuned natural frequency, said second variable representing said tuned natural frequency is selected to be tuned to a natural frequency of at least one of said plurality of low-frequency acoustic modes, said feedback loop transfer function defines a frequency response having a characteristic maximum gain substantially corresponding to the value of said tuned natural frequency, wherein said feedback loop transfer function creates a 90 degree phase lead substantially at said tuned natural frequency; and

a second electronic feedback loop defining a vibro-acoustic controller, wherein said vibro-acoustic controller defines a second electronic feedback loop input coupled to said motion sensor signal and a second electronic feedback loop output, and wherein said second electronic feedback loop is configured to generate said second electronic feedback loop output signal by applying said feedback loop transfer function to said motion sensor signal.

35. (Original) A system for actively damping boom noise as claimed in claim 34 wherein said motion sensor signal comprises an electric signal indicative of measured acceleration detected by said motion sensor as a result of structural vibration of said panel, said acoustic wave sensor signal comprises an electric signal indicative of measured resonance detected by said acoustic wave sensor within said enclosure, and said first and second electronic feedback loop output

signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator.

36. (Original) A system for actively damping boom noise as claimed in claim 34 wherein said motion sensor signal comprises an electric signal indicative of measured acceleration detected by said motion sensor as a result of structural vibration of said panel, said acoustic wave sensor signal comprises an electric signal indicative of measured resonance detected by said acoustic wave sensor within said enclosure, and said first and second electronic feedback loop output signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator, and wherein

said feedback loop transfer function is as follows:

$$\frac{V(s)}{P(s)} = C\frac{s^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \qquad (1)$$

where the units of $V(s)$ corresponds to said rate of change of volume velocity, $P(s)$ corresponds to the pressure at the location of said acoustic wave actuator and said acoustic wave sensor, s is a Laplace variable, ζ is a damping ratio, ω_n is said tuned natural frequency, and C is a constant representing at least one of a power amplification factor and a gain value.

37. (Original) A system for actively damping boom noise as claimed in claim 34 wherein said motion sensor signal comprises an electric signal indicative of measured acceleration detected by said motion sensor as a result of structural vibration of said panel, said acoustic wave sensor signal comprises an electric signal indicative of measured resonance detected by said acoustic wave sensor within said enclosure, and said first and second electronic feedback loop output signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator, and wherein said feedback loop transfer function is as follows:

$$\frac{V(s)}{P(s)} = -C\frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \qquad (2)$$

where the units of $V(s)$ corresponds to said rate of change of volume velocity, $P(s)$ corresponds to the pressure at the location of said acoustic wave actuator and said acoustic wave sensor, s is a Laplace variable, ζ is a damping ratio, ω_n is said tuned natural frequency, and C is a constant representing at least one of a power amplification factor and a gain value.

38. (Original) A system for actively damping boom noise as claimed in claim 34 wherein said motion sensor signal comprises an electric signal indicative of measured acceleration detected by said motion sensor as a result of structural vibration of said panel, said acoustic wave sensor signal comprises an electric signal indicative of measured resonance detected by said acoustic wave sensor within said enclosure, and said first and second electronic feedback loop output signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator, and wherein said feedback loop transfer function is as follows:

$$\frac{V(s)}{P(s)} = C\frac{s^2 + 2\zeta_s\omega_{ns} s + \omega_{ns}^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \qquad (3)$$

where the units of $V(s)$ corresponds to said rate of change of volume velocity, $P(s)$ corresponds to the pressure at the location of said acoustic wave actuator and said acoustic wave sensor, s is a Laplace variable, ζ and ζ_s are damping ratios, ω_n and ω_{ns} are said tuned natural frequencies, and C is a constant representing at least one of a power amplification factor and a gain value.

39. (Original) A system for actively damping boom noise as claimed in claim 34 wherein said motion sensor signal comprises an electric signal indicative of measured acceleration detected by said motion sensor as a result of structural vibration of said panel, said acoustic wave sensor

signal comprises an electric signal indicative of measured resonance detected by said acoustic wave sensor within said enclosure, and said first and second electronic feedback loop output signals are representative of a rate of change of volume velocity to be produced by said acoustic wave actuator, and wherein said feedback loop transfer function is as follows:

$$\frac{V(s)}{P(s)} = C\frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2} \qquad (4)$$

where the units of $V(s)$ corresponds to said rate of change of volume velocity, $P(s)$ corresponds to the pressure at the location of said acoustic wave actuator and said acoustic wave sensor, s is a Laplace variable, ζ is a damping ratio, ω_n is said tuned natural frequency, and C is a constant representing at least one of a power amplification factor and a gain value.

40. (Original) A method for actively damping boom noise within an enclosure defining a plurality of low-frequency acoustic modes comprising the steps of:

securing a motion sensor to a panel of said enclosure, wherein said motion sensor is configured to produce a motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

positioning an acoustic wave sensor within said enclosure, wherein said acoustic wave sensor is configured to produce an acoustic wave sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

positioning an acoustic wave actuator responsive to a first electronic feedback loop output signal and a second electronic feedback loop output signal within said enclosure, wherein said acoustic wave actuator is substantially collocated with said acoustic wave sensor;

coupling a first electronic feedback loop input of a first electronic feedback loop to said acoustic wave sensor signal and a first electronic feedback loop output, wherein said first electronic feedback loop is configured to generate said first electronic feedback loop output signal by applying a feedback loop transfer function to said acoustic wave sensor signal;

coupling a second electronic feedback loop input of a second electronic feedback loop to said motion sensor signal and a second electronic feedback loop output, wherein said second

electronic feedback loop is configured to generate said second electronic feedback loop output signal by applying a feedback loop transfer function to said motion sensor signal; and

operating said acoustic wave actuator in response to said first and second electronic feedback loop output signals.

41. (Original) A method for actively damping boom noise within an enclosure defining a plurality of low-frequency acoustic modes comprising the steps of:

securing a motion sensor to a panel of said enclosure, wherein said motion sensor is configured to produce a motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

positioning an acoustic wave sensor within said enclosure, wherein said acoustic wave sensor is configured to produce an acoustic wave sensor signal representative of at least one of said plurality of low-frequency acoustic modes;

positioning an acoustic wave actuator responsive to a first electronic feedback loop output signal and a second electronic feedback loop output signal within said enclosure, wherein said acoustic wave actuator is substantially collocated with said acoustic wave sensor;

coupling a first electronic feedback loop input of a first electronic feedback loop to said acoustic wave sensor signal and a first electronic feedback loop output, wherein said first electronic feedback loop is configured to generate said first electronic feedback loop output signal by applying a feedback loop transfer function to said acoustic wave sensor signal, wherein said feedback loop transfer function comprises a second order differential equation including a first variable representing a predetermined damping ratio and a second variable representing a tuned natural frequency, said second variable representing said tuned natural frequency is selected to be tuned to a natural frequency of at least one of said plurality of low-frequency acoustic modes, said feedback loop transfer function defines a frequency response having a characteristic maximum gain substantially corresponding to the value of said tuned natural frequency, and wherein said feedback loop transfer function creates a 90 degree phase lead substantially at said tuned natural frequency;

coupling a second electronic feedback loop input of a second electronic feedback loop to said motion sensor signal and a second electronic feedback loop output, wherein said second

electronic feedback loop is configured to generate said second electronic feedback loop output signal by applying said feedback loop transfer function to said motion sensor signal;

selecting a value for said first variable representing said predetermined damping ratio;

selecting a value for said second variable representing said tuned natural frequency; and

operating said acoustic wave actuator in response to said first and second electronic feedback loop output signals.

42-65. (Canceled)

66. (New) A system for actively damping boom noise comprising an enclosure defining a plurality of low-frequency acoustic modes, an acoustic wave sensor, a motion sensor secured to a panel of said enclosure, an acoustic wave actuator substantially collocated with said acoustic wave sensor, and a vibro-acoustic controller, wherein:

said motion sensor is configured to produce a motion sensor signal representative of at least one of said plurality of low-frequency acoustic modes by measuring acceleration resulting from structural vibration of said panel;

said vibro-acoustic controller comprises an electronic feedback loop;

said electronic feedback look comprises a feedback loop input coupled to said motion sensor signal and a feedback loop output coupled to said acoustic wave actuator;

said electronic feedback loop is configured to generate an electronic feedback loop output signal at said feedback loop output by applying a feedback loop transfer function to said motion sensor signal; and

said acoustic wave actuator is responsive to said electronic feedback loop output signal.